



US006285378B1

(12) **United States Patent**
Duluk, Jr.

(10) Patent No.: **US 6,285,378 B1**
(45) Date of Patent: **Sept. 4, 2001**

(54) **METHOD AND APPARATUS FOR SPAN AND SUBSPAN SORTING RENDERING SYSTEM**

(75) Inventor: **Jerome F. Duluk, Jr., Palo Alto, CA (US)**

(73) Assignee: **Apple Computer, Inc., Cupertino, CA (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/264,302**

(22) Filed: **Mar. 8, 1999**

Related U.S. Application Data

(63) Continuation of application No. 08/686,535, filed on Jul. 26, 1996.

(60) Provisional application No. 60/001,529, filed on Jul. 26, 1995.

(51) Int. Cl.⁷ **G06F 15/00**

(52) U.S. Cl. **345/441**

(58) Field of Search **345/418, 419, 345/441, 442, 443, 118, 433**

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,825,391 * 4/1989 Merz 345/431

5,146,592 * 9/1992 Pfeiffer et al. 345/344
5,493,644 * 2/1996 Thayer et al. 345/502
5,977,987 * 11/1999 Dulik, Jr. 345/441

* cited by examiner

Primary Examiner—Phu K. Nguyen

(74) Attorney, Agent, or Firm—Flehr Hohbach Test Albritton & Herbert LLP

(57) **ABSTRACT**

A data shifting capability that permits sorting the data in addition to searching for obtaining real-time performance in color, with high quality imagery through a simple search of a spacial database based on a rectangularly shaped search region or range search. A sorting Magnitude Comparison Content Addressable Memory (SMCCAM) performs a range search, introducing a conservative approximation of the idea Occluding Region, and provides a MCCAM wherein the data words stored in the fields are shifted to corresponding fields in an adjacent word, based on the magnitude comparisons. The 3D graphics method stores the parameters of a polygon span in a spatial database and a query operation is performed on the database to determine which of those spans, or portions of spans, are visible, and applies a rule for comparing a new span portion to an old span portion on a subspan-by-subspan basis, thereby providing additional polygon edge information within a raster line, providing anti-aliasing.

2 Claims, 65 Drawing Sheets

Span Sorting Renderer Architecture

